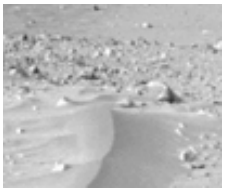
A Sample From Mars



Suggested Grade Level: 3–9

Summary

1. Students will observe the characteristics of a sample that is similar to surface material NASA might one day collect on Mars.
2. Students will classify the sample into groups of materials with similar properties.
3. Students will infer causes for the characteristics of the various materials.
4. Students will draw some conclusions about the geological history of the planet based on the sample material.

Standards

NM Science Content Standards: Strand I, Scientific Thinking and Practice; Strand II, Standard III, Earth and Space Science

National Science Education Standards: Standard A, Abilities Necessary to do Scientific Inquiry

National Math Education Standards: Patterns and Function

Background Information

One of the first things that a mission to another planet generally does is collect and analyze a sample of the rock and "regolith" or fine-grained material at the surface. (Note: The term "soil" is defined as including an organic component and therefore the word "regolith" is used for the fine-grained surface material of other planets.) This surface sample can be analyzed on-site by instruments (as we have done to date with robotic landers and rovers on Mars) or it can be returned for more detailed analysis by scientists on Earth (as we did with the Apollo missions to the Moon). Future robotic missions to Mars are being planned to include a sample return component; this is a very important step in the scientific exploration of the planet because there are some analysis techniques that can only be done by laboratories on Earth.

By analyzing the surface material of a planet, we can tell a lot about the types of geological processes that have operated on that planet. For example, more than one type of material tells us that there are multiple types of rock layers and that the planet is geologically complex. Rounded pebbles represent materials that have been eroded and shaped by wind or water. Cinder, pumice, and perlite mean that volcanism has occurred on the planet. Fragments of fossils or shell imply past or

present life and a water-rich environment. Fragments of petrified wood would imply abundant plant life in the past.

Materials

- ☐ *A Sample from Mars* Data Sheet included with this activity
- ☐ Small magnifying glass or hand lens
- ☐ Toothpick and/or tweezers
- ☐ Planetary sample
- ☐ One piece of white paper

Preparation

1. Prepare a sample for each student team of "Mars" surface material and fill a film canister or equivalent-size plastic container about half-full with the mixture. The exact composition of the sample is not critical, and each sample can be different, but the sample should include as much of the following as possible: coarse and fine sand, small rounded pebbles, small flat pebbles or rock chips (of different types of rock such as sandstone, limestone, basalt), fine table salt, coarse rock salt, cinder, pumice or perlite (from a garden shop), small fossil fragments or broken shells.

   Note: You can prepare your own sample or you can obtain prepared samples for use in this activity by contacting D. Louis Finsand, 1501 W. 19th St., Cedar Falls, Iowa 50613, phone: 319-266-8377.
2. Print and photocopy three copies of the *A Sample From Mars* Data Sheet for each team of students.
3. Each team of students should have a small magnifying glass or hand lens, a piece of white paper, and toothpicks or tweezers to use in separating different materials from their sample.

Introduction for Students

A mission to Mars has returned samples to Earth for scientific study. You are geologists who are members of the mission science team and it is your job to analyze the samples. Each team will be given one sample to study. Each team should make detailed observations of the characteristics of the materials in their sample. Using the Data Sheet, your team should separate and describe the materials within the sample; you can use size, color, shape (rounded or angular), or any other characteristics in order to separate and describe. Describe the material and draw a sketch of each type of material on your Data Sheet. Once you have made detailed observations about the materials, then you should interpret your observations. For example, your observation might be that you identified rounded pebbles in your sample; your interpretation might be that the rounded pebbles were caused by erosion by water.

Procedure

1. Students should work in groups or pairs.
2. Give each team a sample and at least three copies of the Data Sheet along with their scientific instruments (magnifying glass and tweezer or toothpick).
3. Each team should pour their sample onto the white paper and observe as many properties and characteristics as possible about each kind of material they find, then separate the materials into groups, drawing an illustration in each box on the Data Sheet with a short description of each group.
4. Help the students define their basic groups. They may easily choose color or size but then will need help in defining other characteristics such as angularity or translucence.
5. The grid should be used to estimate size categories.
6. The students should share and discuss their observations with other groups.
7. The students should infer causes for the various materials and can make some conclusions about the geological history of the area where the sample was collected.

Process/Closure

This activity uses observation, classification, questioning, and hypothesizing. This is exactly what mission scientists do as they make observations of the surface material on another planet. The MER mission scientists had to do all of this using cameras and robotic instruments. What would it be like to look at this material only through the lens of a camera and not be able to touch it? When a real sample from Mars is returned for study on Earth, the scientists will examine it in the same way that you have. They also will use instruments to acquire detailed chemical analysis of each type of material and dating techniques to find out the age of the material.

Extension/Enrichment

Have students tell a story, draw a picture, or write a paper about the environment of the planet based on the materials they observed.

Have students research the general geology of Earth, Mars, and the Moon and see which general geological environment is closest to their sample.

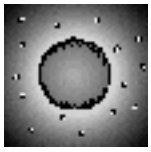
Provide three or four samples that are representations of Earth, Mars, and Moon and have the students compare and contrast these samples.

Ask students to bring in samples for other teams to investigate and compare.

Link to New Mexico by having students compare their sample with one or more soil samples from New Mexico. These samples could be collected from the mountains, along the river, and on a mesa top and then compared.

Credits

Adapted by Kathy Jones, Albuquerque Public Schools, and Judy Stanley, LodeStar Astronomy Center, from *Exploring Crustal Material from a Mystery Planet* by D. Louis Finsand, *Project SPICA K-12 Teacher Resource Manual* and *Mars Activities: Teacher Resources and Classroom Activities*. Data Sheet created for this adaptation by Kathy Jones, Albuquerque Public Schools.



Mars Miscellany

Surface features on all of the planets of our solar system are named by specifically assigned categories and by approval of the International Astronomical Union. Types of geographic features on Mars (such as mountains, plains, and canyons) are called after the Latin designation used by early astronomers. For example, a mountain is called a mons (plural montes), a depression is called a chasma, a large canyon is called a vallis, and a plain is called a planitia or planum. Individual geographic features on Mars are named after certain categories of scientists' names or place names on Earth, including real places and names from classical mythology such as Mount Olympus or Elysium. Small craters on Mars are named after towns on Earth with a population under 100,000—which means there is a Santa Fe crater on Mars.

Name(s) _____ Date _____

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A Sample From Mars

Illustration

Description

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